descended from shelled mollusks, as the embryos are provided with a temporary shell and vellum. At the same time we grant that mollusks and Turbellarian worms may have arisen from the same stem-form.

ZOOLOGICAL NOTES.—Dr. C. F. Holder is authority for the statement he makes in the *Scientific American* that a basking shark (*Cetorhinus maximus*) about seventy feet long was caught off Block island. Sir Charles Lyell records one nearly fifty-five feet long that came ashore at Rathesholm Head, at Stronsa, parts of which are now in the British museum. ——Mr. W. A. Stearns on his return from his trip to Labrador, wrote us that the polar bear had not, so far as he could ascertain, been seen this year below Rigoulet. "Year before last (1880) a walrus was killed at Fox harbor, St. Lewis sound. One of our young men secured the tusks, and has them now in his possession. The people there say that they see them frequently, but rarely get them. One was caught three years ago (1879) also at the same place."——An apparently new species of dog, supposed to have been received from the Upper Amazons, has been described in the Proceedings of the Zoölogical Society of London under the name *Canis microtis*.——Professor Flower also exhibited and remarked on the skull of a young chimpanzee from Lado, in the Soudan, which exhibited the deformity called acrocephaly, associated with the premature closure of the fronto-parietal suture.——Mr. Dobson maintains that the Dipodidæ belong with the hystricine, and not to the murine rodents.——The genus Psolus has been divided into three subgenera by Professor Bell.——M. Jourdain, of Marseilles, has recently published in the *Comptes Rendus* of the French Academy, an abstract of his studies on the finer structure of the male sexual organs and the Cuvierian organs of Holothurians, also on the histology of the digestive canal, nervous system and polar vesicles of these Echinoderms; his researches, made at the marine zoölogical laboratory of Marseilles, will be completed by studies in the circulatory apparatus of these animals.——A crinoid was obtained during the voyage of H. M. S. *Alert*, which was referred by Professor Bell to a new variety of *Antedon eschrichtii* of the arctic seas.

PHYSIOLOGY.[1]

THE RECENT ACCESSIONS TO OUR KNOWLEDGE OF THE PHYSIOLOGY OF THE HEART.—The heart in its final function is simply a pump, and it would no doubt be possible to remove this organ from the body of a living animal, and replace it by an artificial machine which should, for a time, serve very well the purposes of the heart in the circulation of the blood. As the circulation of the blood is every instant necessary to vital activity, and as, other things remaining the same, any change in the force or frequency

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

of the heart-beat must make itself felt in changing the character of the circulation, physiologists have recognized as of fundamental importance to the understanding of this subject, the clear comprehension of every physiological factor which can in any way modify the action of the heart. Of the reality of such modifying influences any one who compares his pulse rate, oberved in a standing and a sitting position, may be convinced.

The factors which must be considered as having a possible or certain influence on the rhythm and character of the heart-beat have been for several years distinctly recognized, they are: (1) the nerves connecting the heart with the brain and spinal cord; (2) the temperature of the blood supplying the heart; (3) the chemical constitution of the blood; (4) the pressure of the blood within the heart, and in the arteries outside the heart.

In 1846 Ed. Weber published the account of his brilliant researches in which he declared that when the pneumogastric nerve or the nervous centers in the *medulla oblongata*, are electrically stimulated, the pulse is slowed or the heart even brought to a complete standstill. It is now one of the settled theorems of physiology, that there is in the medulla a "cardio-inhibitory center" from which spring nerves that carry to the heart impulses which cause slowing or even stopping of its action. Some years since, Goltz showed that the cardio-inhibitory center could be excited by impulses reaching it by way of afferent nerves from various parts of the body, the excitement of the center being manifested in a slowing or stopping of the heart-beat. Many subsequent workers have shown that the cardio-inhibitory center is exceedingly susceptible to psychical or physical changes of condition in the the body; but that all modification of the heart-beat under these circumstances disappears so soon as both pneumogastric nerves are divided in the neck.

V. Bezold and his pupils more than ten years ago demonstrated that when certain nerve branches reaching the heart from the spinal cord through the last cervical and first thoracic sympathetic ganglia, are stimulated, the beat of the heart is quickened.

Until within a few months these changes of the rhythm of the heart-beat were the only ones which could be definitely shown to be brought about by nervous action. Within the last year, several physiologists, Heidenhain (Pflügers Archiv. Rd xxvii), Gaskell (Proc. Royal Soc. Dec. 8, 1881), Sewall and Donaldson (Journ. of Physiology, Vol. iii, Nos. 5 and 6), working independently and by quite different methods, have shown that stimulation of the pneumogastric nerve of the frog may bring about a weakening of the heart-beat without any corresponding alteration in the rhythm of the beat. So that it is a fair conclusion that definite nerve fibers carry from the brain to the heart of the frog impulses which cause weakening of the contractions of the heart without altering their rate. These *relaxing* fibers being bound in the same nerve

bundle with the cardio-inhibitory branches, their action is, in ordinary cases of stimulation, obscured by that of the latter. All physiological analogy suggests the existence of nerve fibers of similar function in the higher animals.

Gaskell (Journ. Physiology Vol. III, Nos. 5 and 6), has gone farther than this, and shown that stimulation of the pneumogastric causes, under certain conditions, strengthening, instead of weakening, of the heart-beat without alteration of its rhythm; and in the tortoise he has actually dissected out a nerve twig, running over the surface of the heart, the stimulation of which causes simple strengthening of the heart-beat uncomplicated by any other modification.

It is, then, to-day clear that all the variations of force and frequency of action to which we know the heart-beat is subject, may be brought about by the excitement of certain nervous centers in the brain; and as nature is not in the habit of letting her powers lie idle, it is pretty certain that nervous impulses with the four distinct missions that have been indicated do, in the living body, descend from the brain to modify the action of the heart.

In the living animal the arteries are overfull, and the elastic arterial wall straining upon the blood inclosed by it, forces the fluid with a definite pressure onward on its path of circulation. It is this pressure of the blood in the aorta which the heart must overcome in emptying its ventricles; and it is a question of fundamental physiological importance whether in the mammal variations in arterial pressure, that is the resistance which the heart has to overcome, cause corresponding variations in the pulse rate. This problem, whose solution is apparently so simple, has been answered in every possible way by different and equally competent experimenters. With the heart in the body, and in physiological connection with the vascular apparatus, the conditions of experimentation are hopelessly complicated.

A little more than a year ago, Professor Martin at Baltimore (Studies Biol. Lab. Johns Hopkins Univ. Vol. II, No. 1), hit upon an ingenious and simple method of isolating completely the living mammalian heart from the rest of the body. Martin's method consists, essentially, in opening the chest of a completely narcotized dog; all the arteries arising near the heart are tied, except two; one of these is connected with a mercury manometer, by means of which the amount of blood pressure and the pulse rate are recorded; the other open artery has inserted in it a tube through which blood may flow from the heart. All the great veins entering the heart are tied, except one, and into this is allowed to flow warm defibrinated blood from a flask. When the proper temperature and artificial respiration are maintained, the heart may continue to beat normally for hours. On the heart thus severed from its physiological connection with every other organ, a most important and interesting series of studies has been made by Professor

Martin and his pupils (Stud. Biol. Lab. J. H. Univ. Vol. II, No. 2, Trans. Med. Chirurg. Fact. Md. 1882). It has been found that variations of enormous extent of either arterial pressure, the resistance to the outflow of blood from the heart, or of venous pressure, that under which blood enters the heart, have no effect whatever upon the pulse rate. The work has furthermore suggested to its author some simple explanations of the causes of the conflicting results of previous experimenters. But Martin has found, as was to be expected, that, though the pulse rate is unaltered by great changes in the mechanical conditions under which the heart acts, the organ is extremely susceptible to changes of temperature, and beats uniformly quicker or slower as the temperature of the blood entering it rises or falls the fraction of a degree. The application of this new method of studying the mammalian heart opens the way for a series of researches that promises rich results for physiology.

In connection with this subject, the recent work of Ludwig and Luchsinger is of considerable interest (Pflüger's Archiv. Bd. xxv). These authors showed that the inhibitory power which the pneumogastric nerve when stimulated, exercises over the heart-beat of the frog, is diminished or altogether overcome by increasing intracardiac pressure. Later, Sewall and Donaldson taking up the same line of work (*loc cit.*), have found that it is only the fluid pressure within the venous chambers of the heart which has an effect in modifying the power of pneumogastric inhibition; thus showing that changes in the hydrostatic conditions under which the heart works may affect the action of that organ indirectly, through increasing or decreasing the efficiency of controlling influences reaching it along certain nervous paths; though such changes of fluid pressure may in no wise alter the rhythm of the pulse when the heart is kept strictly to itself.

If the results which have come out of the study of the physiology of the heart during the last year or two, are to stand, we shall be led to conclusions that make a new chapter in physiology.

We must look upon the heart as an automatic organ whose action has a definite rhythm, which is to an extraordinary extent unaffected by changes of condition operating directly upon the organ itself. But the heart is in nervous connection with various centers of the brain, which, it is fair to assume, are extremely sensitive to all those changes of condition in the body to which the heart, by an altered rhythm or force of beat, must coördinate its action. To use a figure of speech, the nervous master in the brain is the first to perceive the needs, as to the circulation, in the whole or any part of the body, and is most alert to answer them; while the muscular servant, the heart, has enough to do to carry on its work of prime importance, and is blind and deaf to nearly all occurrences except those messages that reach it from headquarters.

THE POISON OF THE SCORPION.—The poison and poisoning-apparatus of the scorpion have been recently made an object of study by M. Joyeux-Laffuie. The former, he finds, is very active, though not so powerful as some have represented. A drop of it, either pure or mixed with a little distilled water, rapidly kills a rabbit, when injected into the cellular tissue. Birds are as easily killed with it as mammals. One drop suffices to kill seven or eight frogs. Fishes, and, above all, mollusks, are much more refractory. But, on the other hand, the articulata are wonderfully susceptible; the hundredth part of a drop will immediately kill a large crab. Flies, spiders and insects on which the scorpion feeds, are quickly affected by its sting. The poison soon paralyzes the striated muscles, suppressing spontaneous and reflex movements. In all animals there is first excitation, then paralysis. The author regards the scorpion's venom as a poison of the nervous system, not a poison of the blood, as M. Joussel de Bellesme asserts.

ELECTRIC ORGANS OF GYMNOTUS.—In the appendices to Sachs and Du Bois Reymond's work on the electric eel, G. Fritsch gives an account of his histological and morphological investigations on the nervous and electric apparatus. He finds, says the Journal of the Royal Microscopical Society, support for the doctrine that the electric organs of Gymnotus have been developed from transversely striated muscle; a portion, the lowest lateral muscles, having been separated from the rest to form the so-called intermediate muscular layer, while a superior mass of muscle was converted into the great electric organ.

SENSE OF SMELL IN ACTINIÆ.—It has been discovered by Mr. W. H. Pollock and Dr. G. J. Romanes, that the common sea-anemone is conscious of the presence of any kind of food (pieces of cockle, mussel, &c.), placed near them. If the food was held within a span's breadth of an anemone it opened; if it was held in the centre of a circle of anemones they gradually opened in succession. They were found, however, to be unable to localize the direction in which the food was lying. Dr. Romanes considers that the sense which is thus shown to be possessed by these animals may most properly be called a sense of smell, and they are the lowest animals in which any such sense has hitherto been noticed.—*Journal of the Royal Microscopical Society.*

SALINE ELEMENTS IN THE BLOOD OF MARINE CRUSTACEA.—It has been observed by M. Fredericq (Bull. Belg. Acad.) that the blood of crabs and other Crustaceans at Ostend has the same strong and bitter taste as the sea water, and proves to have the same saline constitution. Crabs in brackish water, on the other hand, have a less salt blood, and the crayfish of rivers have very little of soluble salts in their blood. An exchange of salts seems to take place in these animals between the blood and the outer medium, producing approximate equilibrium of chemical composition. This

probably occurs through the respiratory organ, and is according to the simple laws of diffusion. On the other hand, the blood of sea-fishes, has an entirely different saline composition from that of the water; it is more or less isolated, presenting herein an evident superiority over the invertebrates referred to.—*Nature.*

PSYCHOLOGY.

ANECDOTE ABOUT CATS.—Incidents showing some power of reason are often related of animals, especially those domesticated; but I do not think the following have ever appeared in print: Near Vineland, N. J., some boys discovered a woodchuck's burrow (*Arctomys monax* L.), containing both adults and four young. The father and two of the young were killed; the mother and the other two young were taken home, and imprisoned. During the night the mother made her escape. As a matter of experiment, the young were placed with a cat, at that time suckling her two kittens. Shortly after the cat came into the house somewhat uneasy. One of the boys went out with her to the novel family, and finally succeeded in pacifying her to such an extent that she allowed the strangers to suckle. But now a new difficulty arose. There were but two teats sufficiently developed to afford nourishment. A struggle ensued as to who should obtain possession. The woodchucks being the stronger, came off victorious. The kittens showed their dislike to this arrangement by scratching and pushing, and as it was evident that two of the four must be removed, a decision was given in favor of the woodchucks. Shortly after, one of them died; whether the other ever reached maturity or not, I do not know, but understood that it continued to suck the cat for some time. That cats are not always so accommodating as the above individual, I know from the fact, that once when I endeavored to have a cat with three kittens assume charge of two more, I was obliged to hastily withdraw them to prevent their being killed. In another case one kitten was nourished by two cats. As to whether either was the parent or not, I cannot say. Once when the mothers desired to remove their child from the mill where it was then located, to a neighboring house, they found their infant, corpulent with the abundant nourishment, too heavy for either alone, and consequently were obliged to carry it between them.—*Henry Turner.*

THE MODIFIED INSTINCTS OF A BLIND CAT.—Mr. H. C. Hovey contributes to the *Scientific American* the following interesting article on the modified instincts of a blind cat. The family favorite, whose misfortunes have afforded an opportunity to observe the workings of instinct under difficulties, is a noble specimen of the genus Felis. "Dido" is his name—given for simple euphony, without regard to gender. During the four years of his life he has never been known to do anything wrong, unless it be to fight